

What we claim is:

1. A method for molding an upper and a lower mold having no flask and that match each other, comprising:

(1) a putting and holding process to put a match plate in between an upper and a lower flask having intakes for foundry sand and being horizontal and to hold the match plate,

(2) a defining process to define an upper and a lower molding space by inserting an upper and a lower squeeze means into openings of a pair of the upper and the lower flask having no match plate,

(3) a rotating and moving process to rotate the pair of the upper and the lower flask and the match plate so that they are perpendicularly positioned, and to move them so that the intakes of the upper and the lower flask move upward,

(4) a filling process to fill the upper and the lower molding space with the foundry sand through the intakes of the upper and the lower flask,

(5) a squeezing process to squeeze the foundry sand of the upper and the lower molding space by causing the upper and the lower squeeze means to further approach each other,

(6) a rotating process to rotate the pair of the upper and the lower flask and the match plate so that they are horizontally positioned, and

(7) a removing process to remove the match plate disposed between the upper and the lower flask after separating the upper and the lower flask containing a mold from the match plate,

wherein, while the preceding processes are being carried out,

(8) the core is installed between the upper and the lower mold, if necessary,

(9) the upper and the lower flask containing the mold are matched to each other, and

(10) the molds are removed from a pair of the upper and the lower flask that are caused to match each other.

2. A method of claim 1, wherein,

(2) the defining process to define the upper and the lower molding space by inserting the upper and the lower squeeze means in openings of the pair of the upper and the lower flask having no match plate, and

(3) the rotating and moving process to rotate the pair of the upper and the lower flask and the match plate so that they are perpendicularly positioned, and to move them so that the intakes of the upper and the lower flask move upward, are simultaneously carried out.

3. A method of claim 1,

wherein the squeezing process to squeeze the foundry sand of the upper and the lower molding space by causing the upper and the lower squeeze means to further approach each other, and the rotating process to rotate the pair of the upper and the lower flask and the match plate so that they are horizontally positioned, are simultaneously carried out.

4. A method of claim 1,

wherein an upper and a lower squeeze plate are provided as the upper and the lower squeeze means.

5. A method of claim 1,

wherein upper and lower segmented-squeeze feet are provided as the upper and the lower squeeze means.

6. A method of claim 4, wherein after the filling process to fill the upper and the lower molding space with the foundry sand through the intakes of the upper and the lower flask is completed, it further comprises:

a) a process to move further apart the upper squeeze plate from the lower squeeze plate to a predetermined distance, and

b) a filling process to fill the upper and the lower molding space with the additional foundry sand through the intakes of the upper and the lower flask.

7. A method of claim 6, wherein,

a) the process to move further apart the upper squeeze plate from the lower squeeze plate to a predetermined distance, and

b) the filling process to fill the upper and the lower molding space with the additional foundry sand through the intakes of the upper and the lower flask are simultaneously carried out.

8. A method of claim 5,
wherein (2) the defining process to define an upper and a lower molding space by inserting the upper and the lower squeeze means into openings of a pair of the upper and the lower flask having no match plate further includes a setting process to set the distance between the pattern of the match plate and each of a plurality of the upper and lower segmented-squeeze feet so that each ratio of the distance after squeezing and that before squeezing becomes equal.

9. A method of claim 5,
wherein (2) the defining process to define the upper and the lower molding space by inserting the upper and the lower squeeze means into openings of a pair of the upper and the lower flask having no match plate further includes a forming process to form the molding space defined by the pattern of the match plate and each of a plurality of the upper and lower segmented-squeeze feet so that the foundry sand can easily flow in the molding space.

10. A method of claim 9,
wherein the forming process to form the molding space defined by the pattern of the match plate and each of a plurality of the upper and lower segmented-squeeze feet so that the foundry sand can easily flow in the molding space further includes a reducing process to reduce the friction between the foundry sand and a wall of an aeration tank by jetting air into a nozzle of the aeration tank and a portion where it is difficult for the foundry sand to flow.

11. A method of claim 5,
wherein (4) the filling process to fill the upper and the lower molding space with the foundry sand through the intakes of the upper and the lower flask and (5) the squeezing process to squeeze the foundry sand of the upper and the lower molding space by causing the upper and the lower squeeze means to further approach each other further include

a) a first filling process to fill the upper and the lower molding space defined by the upper and the lower flask, the upper and the lower squeeze means, and the match plate, which are perpendicular, with the foundry sand

through the intakes of the upper and the lower flask,

b) a first squeezing process to squeeze the foundry sand of the upper and the lower molding space by causing a plurality of the upper and lower segmented-squeeze feet of the upper and the lower squeeze means to further approach each other,

c) a second filling process to fill the upper and the lower molding space with the additional foundry sand through the intakes of the upper and the lower flask after the retracting process to retract the upper and lower segmented-squeeze feet, and

d) a second squeezing process to squeeze the foundry sand of the upper and the lower molding space by simultaneously causing the upper and lower segmented-squeeze feet, whose surfaces are arranged in a plane, to further approach each other.

12. An apparatus for molding an upper and a lower mold that match each other and that has no flask, comprising:

(1) two pairs of an upper and a lower flask each having intakes disposed at their side walls for foundry sand,

(2) a match plate disposed between one of the two pairs of the upper and the lower flask so that the match plate can be inserted in and taken out between one of the two pairs of the upper and the lower flask by a conveying apparatus,

(3) a squeezing mechanism to squeeze the foundry sand, which supports a pair of the upper and the lower flask having the match plate between the upper and the lower flask, which supports the upper and the lower squeeze means inserted in openings of the upper and the lower flask having no match plate so that the squeeze means can be taken out, and which can clockwise or counterclockwise rotate in a perpendicular plane about a supporting shaft so that the pair of the upper and the lower flask having the match plate between the upper and the lower flask can become perpendicular and horizontal,

(4) a driving mechanism to clockwise or counterclockwise rotate the squeezing mechanism,

(5) an aeration mechanism to discharge the foundry sand into the upper and the lower flask, which are both perpendicular, by means of the driving mechanism, through the intake,

(6) a removing mechanism to remove an upper and a lower mold from a pair of the upper and lower flask containing a mold, and matched to each other, and which are horizontal, and

(7) a rotating mechanism to alternately and intermittently rotate the two pairs of the upper and the lower flask, which are horizontal, between the squeezing mechanism, which is horizontal, and the removing mechanism, and to lift and lower the upper flask.

13. An apparatus of claim 12,

wherein the upper and the lower squeeze plate are provided as the upper and the lower squeeze means.

14. An apparatus of claim 12,

wherein upper and lower segmented-squeeze feet are provided as the upper and the lower squeeze means.

15. An apparatus of any of claims 12—14,

wherein the removing mechanism to remove an upper and a lower mold is comprised of:

a) a supporting member to support the molds, which supporting member has a rectangular plate, can be lifted and lowered, and can be inserted in the lower flask,

b) a lower fluid cylinder disposed under the supporting member to lift and lower the supporting member,

c) a lower lifting and lowering table, wherein the lower fluid cylinder is disposed under the lower lifting and lowering table,

d) a lower folding and retractable mechanism to lift and lower the lower lifting and lowering table, which is disposed under the lower lifting and lowering table,

e) a pressing member to press the molds out, which pressing member has a rectangular plate, is disposed above the supporting member at a set distance away from it, and can be moved up and down and inserted in the upper flask,

f) an upper fluid cylinder disposed above the pressing member to lift and lower the pressing member,

g) an upper lifting and lowering table, wherein the upper fluid

cylinder is disposed above the upper lifting and lowering table, and

h) an upper folding and retractable mechanism to lift and lower the upper lifting and lowering table, which is disposed above the upper lifting and lowering table.

16. An apparatus of claim 15,

wherein the lower and the upper folding and retractable mechanism of the removing mechanism are a toggle mechanism or a pantograph mechanism.

17. An apparatus of either of claims 15 and 16,

wherein the upper and the lower fluid cylinder of the removing mechanism are a hydraulic cylinder and a pneumatic cylinder respectively.

18. A method for replacing the match plate by using the rotating mechanism of any of claims 12—14, further comprising:

a) a raising process to raise two upper flasks of two pairs of the upper and the lower flask,

b) a carrying process to carry the match plate to the upper flask positioned at the squeezing mechanism by a carriage,

c) a carrying process to carry the match plate to the upper flask positioned at the removing mechanism by a carriage,

d) a moving process to move the match plate positioned at the squeezing mechanism to the removing mechanism, and to move the match plate positioned at the removing mechanism to the squeezing mechanism by driving the rotating mechanism, and

e) a carrying-out process to carry out two match plates that are rotated and moved between the squeezing mechanism and the removing mechanism.